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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/757,123	01/09/2001	Satish Athavale	01P7408US	6586

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Siemens Corporation
Intellectual Property Department
186 Wood Avenue South
Iselin, NJ 08830

EXAMINER

DEO, DUY VU NGUYEN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 03/25/2003

12

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/757,123

Applicant(s)

ATHAVALA ET AL.

Examiner

DuyVu n Deo

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 January 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1, 14, 23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The limitation “ground rule design” is not defined by the specification; therefore, it is unclear what “ground rule design” is by the claims. At this time, it would be understood as the trench diameter.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Singh et al. (US 6,042,687), DeOrnellas et al. (US 6,046,116), Yang (US 5,827,437), and Muller et al. (US 5,605,600).

Singh discloses a plasma processing system and method for processing substrates. The plasma processing system comprises a processing chamber enclosing a substrate support assembly. The substrate support may comprise an RF powered electrode (col. 3, lines 60-67). The substrate may be clamed to the electrode (col. 4, lines 3-4). A substrate is processed in the

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chamber by energizing a process gas into a HDP. This reads on the applicant's limitation of a wafer comprising a silicon substrate.

Unlike claimed invention, Singh does not teach a method for heating the wafer to T greater than 200 degrees Celsius.

DeOrnellas discloses a method for performing an etch operation in a reactor. A wafer is positioned over a bottom electrode in an etching chamber (col. 3, lines 6-9). A wafer clamp holds the wafer against a lower electrode (col. 3, line lines 36-40). A resistance heater is contained in the lower electrode. The electrode is heated in order to heat the wafer (col. 3, lines 49-55). During etching, the T of the wafer reaches 275 degrees Celsius (col. 4, lines 38-40). The helium pressure is generally about 3 torr or greater (col. 4, line 6-10). This reads on the applicant's limitation of applying a backside pressure of about 6 torr or greater.

It is the Examiner's position that a person having one ordinary skilled in the art would have found it obvious to modify Singh with the method of heating the wafer to a T of greater than 200 degrees Celisius as taught by DeOrnellas. This additional step would have been obvious in order to control the T of the wafer which would minimize the critical dimension growth (DeOrnellas, col. 1, lines 55-57). Please also see *ex parte Khusid*, 174 USPA 59.

Unlike claimed invention, above prior art doesn't teach a method for exposing the wafer to a reactive plasma to etch trenches into the wafer.

Yang discloses a plasma reactor. A wafer is introduced into the chamber and disposed on an electrostatic chuck which acts as an electrode and is biased by an RF generator. The wafer is clamped onto an electrostatic chuck. A helium cooling gas may be introduced under pressure to act as a heat transfer medium for accurately controlling the wafer's T during processing to ensure

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uniform etching results (col. 5, lines 23-40). A plasma is created from an etchant source gas in order to etch a wafer (col. 5, lines 45-47). The gas includes Cl_2 , BCl_3 , and N_2 or Ar. An ARC, a hardmask, is formed over the silicon substrate. This reads on applicant's limitation of forming a hardmask on a silicon substrate of a wafer. A patterned photoresist layer is formed over the hardmask layer (col. 10, line 55-60). The etchant source gas is used to etch narrow trenches into the wafer (figure 1B).

It is the examiner's position that a person having ordinary skilled in the art would have found it obvious to modify Singh and DeOrnellas with the method of exposing the wafer to a plasma to etch trenches in the wafer as taught by Yang since Singh is not particular about the type of structures formed as a result of plasma etching. Therefore, the formation of trenches would have been obvious in order to achieve a reasonable expectation of success.

Unlike claimed invention, above prior art doesn't teach a method for etching a deep trenches having a depth of 8 μm or greater.

Muller teaches a method of etching a wafer wherein the trench depth is about 8 μm (col. 3, line 23). It would have been obvious for one skilled in the art to modify above prior art's method in light of Muller in order to form a capacitor having tapered trench sidewall which is the optimum trench profile (col. 3, line 13-25).

Even though above prior art doesn't describe the etching method is for a ground rule design (trench diameter) of 175 nm or less. However, this would depend on the type of semiconductor device being processed. Pages 1 and 2 of the specification show that a DRAM would have a 175 nm ground rules or below. Therefore, at the time of the invention, it would have been obvious to one skilled in the art that depending the type of semiconductor device

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being fabricated, the etching method can be used for a ground rules such as 175nm in order to form a DRAM.

Singh further discloses the process gas can includes a mixture of Cl₂ and BCl₃. A secondary gas supply can comprise one ore more inert gases such as Ar or He and a substrate passivating gas such as nitrogen or oxygen. Therefore, the wafer is exposed to a reactive plasma including Cl₂, BCl₃, Ar, O₂, and N₂ (col. 4, lines 29-46). The substrate is cooled through backside helium cooling. In one example, 8 torr of backside helium pressure is applied (col. 6, lines 9-14). The baseline parameters are 150 sccm Cl₂, 10 mtorr, 200 Watts of bias power, 6 torr of He backside pressure, and 60 degrees Celisius for the chamber and electrode T. the wafer is clamped to the electrode (col. 4, lines 3-4). Therefore, the heat from the electrode is transferred to the wafer. This reads on the applicant's limitation of maintaining the wafer at about the same T as the electrode.

Response to Arguments

5. The applicant's arguments filed 1/23/03 have been fully considered but they are not persuasive.

In response to applicant's argument that applied prior art doesn't teach the method is for a ground rule design of 175 nm or less, a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA

1963). Furthermore, pages 1 and 2 of the specification show that a DRAM would have a 175 nm ground rules or below. Therefore, at the time of the invention, it would have been obvious to one skilled in the art that depending the type of semiconductor device being fabricated, the etching method can be used for a ground rules such as 175nm in order to form a DRAM.

Referring to the limitation of a depth of about 8 um or greater. Muller does disclose a 8 um depth trench (col. 3, line 23).

Conclusion

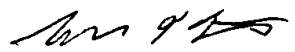
6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD

March 20, 2003


BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700